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**Attachments:** [MDEQ Comments on Area 1FS v20130129.docx](#)  
[MDEQ Response to EPA Request RE Area 1FS v20130129.docx](#)  
[FishTrendGraphs Remedial Options.pdf](#)

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## MDEQ Comments

### Area 1 FS for Kalamazoo Superfund Site dated October 30, 2012

The draft Area 1 Feasibility Study (Area 1 FS) Report for the Kalamazoo River Superfund site has a number of deficiencies that must be corrected to ensure that sufficient information is available to EPA to support selection of a protective remedy for Area 1. Key deficiencies include the lack of a remedial action objective focused on reducing fish tissue concentrations to acceptable levels, the failure to clearly document protective risk based tissue concentrations, the lack of a fish tissue/sediment relationship that can be used to support the development of sediment cleanup levels, and the failure to fully consider the effect of background on the level of risk reduction that a sediment cleanup could realistically achieve. In addition, the draft Area 1 FS fails to evaluate a sufficient range of remedial action alternatives. Based on information presented in the draft Area 1 FS, only Alternative 6 achieves meaningful risk reduction relative to the no-action alternative while alternatives 3A/B, 4A/B, and 5A/B are essentially indistinguishable from one another from the standpoint of risk reduction. More importantly, the alternatives 2, 3A/B, 4A/B and 5A/B fail to meet EPA's protectiveness criteria for systematic toxicants under the National Contingency Plan (NCP) by failing to achieve a hazard quotient of 1.0 under the reasonable maximum exposure (RME) scenario evaluated in the baseline human health risk assessment.<sup>1</sup>

#### Key Comments

##### **Key Comment 1: Fish tissue trend analyses must account for lipid trend**

The PCB decay trends presented in the draft Area 1 FS based on wet-weight PCBs overstate the rate of PCB decline in carp and smallmouth bass tissue samples. Lipid content was found to explain a significant portion of the PCB decline. Therefore, much of the apparent decay of PCBs in tissue is explained by temporal variation in lipid content (see Kern report for full discussion). Extrapolation of wet weight PCB decay trends requires the untenable assumption that lipid content trends will continue to decline through time as well. However, it is not biologically possible for lipids to decline below species specific minimums and thus PCB trend calculations need to consider and compensate for lipid trends. See attached Kern report for a defensible approach to calculate PCB trends in fish tissue while accounting for variation in lipid content.

##### **Key Comment 2: Fish tissue trends substantially overestimate PCB decay rates**

After adjusting for co-variation with lipid, temporal trends in tissue PCB concentrations were on the order of 3% per year as compared to 6% reported in the FS. Assuming these decay rates would continue indefinitely into the future, time horizons to even minimally protective fish tissue concentrations (e.g. Central Tendency Sport Angler, 100% smallmouth bass diet, tissue level of 0.2mg/kg ) are on the order of 30 or more years as opposed to the much shorter time horizons reported in the FS. Further, fitting a mixed order model to fish tissue data indicated that decay rates are slowing with time, indicating that the assumption of indefinite first order decay rates represents optimistic forecasts. The PCB fish tissue trends must be re-analyzed to appropriately inform decision-making on the expected response of the Kalamazoo River system (see attached Kern report for recommended analytical methods).

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<sup>1</sup> "RULES OF THUMB FOR SUPERFUND REMEDY SELECTION", OSWER 9355.0-69, Page 7

**Key Comment 3: The use of biased, hot spot sampling results in low estimates of surface weighted average concentrations (SWACs)**

The methods used in the draft Area 1 FS to estimate SWACs in Area 1 river sections incorrectly combined “judgmentally-located” (i.e. biased) samples with unbiased samples, understating the average PCB concentration in surface sediments by up to a factor of 9. This estimation bias is caused by 1) incorrect handling of data generated through post-hoc identification of hot-spot investigation areas; and 2) improperly combining biased and unbiased data within stream tubes in “non-hot-spot” areas. To avoid this problem of combining biased and unbiased data for wide ranging terrestrial species, it was agreed in the EPC work group meetings that only unbiased data would be used to estimate SWACs. The same rationale suggests that unbiased sample data should also be used for estimation of PCB exposure (i.e. SWAC) for wide ranging aquatic species including smallmouth bass and common carp.

It is recommended that the SWAC estimates reported in the Area 1 FS be replaced with estimates based on the arithmetic average of unbiased samples collected in 1993/94. Transect based, apparently unbiased, sampling programs were also conducted in 2000 and 2007, although it is unclear whether the spatial extent and balance is similar to that obtained in 1993/94, so uncritical use of these samples may also cause unintended biases. If the RPs desire to combine samples collected in 2000 and 2007 with those from the 1993/94 survey, they should be carefully evaluated in consultation with USEPA and the MDEQ prior to incorporation into SWAC estimates. Detailed findings supporting this comment can be found in the accompanying Kern report.

**Key Comment 4: Incorporation of risk based goals into evaluation of remedial alternatives**

The FS initially discusses a range of PRGs based on the results of the human health risk assessment. These PRGs are not developed into RGs or used to develop SWAC estimates in a manner useful to evaluation of the range of clean-up alternatives that could be considered. In particular, the first 5 alternatives do not demonstrate protectiveness even over an extended time frame. These alternatives all focus exclusively on removal only of sediments containing 50 ppm total PCB or more. Thus, almost all of the alternatives that are evaluated in detail result in essentially the same (small) risk reduction. Alternative 6 does demonstrate protectiveness within a reasonable time frame, but this single alternative is not sufficient for evaluating cost/benefit relationships between active sediment removal and predicted reductions in tissue concentrations, and hence reduction in health risks for fish consumers. Full analysis of alternatives using RALs of 1, 2, 5 and 10 ppm total PCB to define areas for active remediation should be included in the FS and cost/benefit assessment completed.

**Key Comment 5: Application of RGs and SWAC estimates by river segment**

The FS evaluates only the entire reach of Area 1. This approach is inconsistent with the risk assessment, which broke segments up into ABSA, and with the RI which separately considered 9 different river segments. The analysis also ignores evaluation of smallmouth bass home ranges, (approximately 1 mile) and the results of updated risk calculations, which show that PCB concentrations in smaller home range panfish, as well as other species, suggest similar risks for mixed species diets (excluding carp) as originally estimated.<sup>2</sup>The FS should evaluate alternatives by river

<sup>2</sup> “Final (Revised) Human Health Risk Assessment, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site,” prepared for Michigan Department of Environmental Quality by CDM, April 2003.

segment, using the 9 segments identified in the RI as a starting point. This more rigorous analysis will provide a much better illustration of sediment volumes to be removed and associated cleanup costs and will allow for the development of remedial action alternatives that target the areas of the site where cost effective risk reduction may be achieved. As indicated in Comment 1, cost/benefit analysis, as measured by volume/risk reduction relationship, is key to decisions regarding sediment remediation.

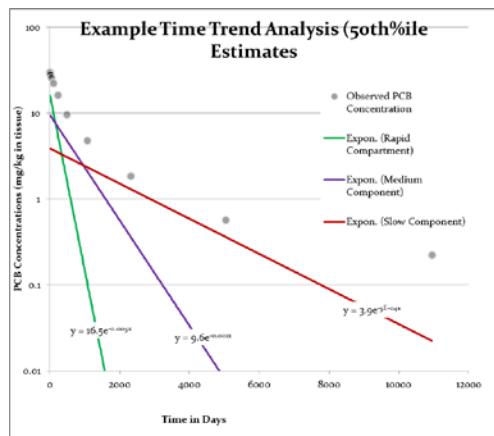
**Key Comment 6: Incorporation of data collection during remedial design and monitoring post-remediation**

Each alternative should include additional data collection to reduce uncertainties and support remedial design. Each alternative should also include a general plan for establishing a baseline for sediment and tissue concentrations, and for monitoring the success of remediation. Analysis of available river transects will allow some understanding of combined variables, such as river slope versus PCB concentrations, that will support development of cost versus risk reduction estimates as noted in Comment 2. That is, it seems likely that sediment removal for any given RAL can be targeted such that (a) greatest reduction in sediment PCBs can be achieved most efficiently and (b) appropriate river segments can be identified where SWACs are already met and thus no active remediation would be necessary. This level of analysis will provide appropriate differentiation among alternatives and allow a useful range of alternatives to be considered.

**Key Comment 7: Use of time trends for tissue and sediment**

Time trends suggested by available data are critical for evaluation of FS alternatives that use risk-based SWAC. That is, for alternative 6 and additional alternatives as discussed in Comment 1. Data are quite noisy, however, even after lipid and TOC correction, and use of simple first order kinetics both overestimates rate of PCB decay in tissues and underestimates uncertainties. Thus, uncertainties become an indispensable part of interpreting time to reach tissue remediation goals. Furthermore, analysis suggests that much of the estimated decline in tissue levels may be explained by a decline in lipid content. The analysis in the FS concerning modeling is based on an assumption of first order kinetics for all process related to uptake of PCBs into fish tissue, and that the combinations of first order processes must also be first order. This interpretation is rather naïve. Just consideration of typical biological processes demonstrates how common second and higher order (mixed order) processes are. As an example, available time trend analyses show how combinations of processes, even if all are first order, result in complex time trends. For example, assume three trends represent three first order PCB tissue relationships. Trend one, declining surface water concentrations, was assumed to be a surrogate for uptake of PCBs across fish gills. Trend two, declining smallmouth bass tissue concentrations, was assumed to be a surrogate for an intermediate uptake process, perhaps via diet. Trend three, lack of declining sediment concentrations was assumed to be a surrogate for process that is changing only slowly. This process could be, as an example, direct uptake via sediment ingestion or exposure to pore water. Since sediment concentrations may not be declining, such processes could represent something of a baseline. Finally, a constant term was assumed to represent regional background. Results of combining these three trends are represented in the figure below.

**Commented [A1]:** Need a key comment after this one that summarizes Kern's modeling approach and conclusions. This comment is only intended to show that combining first order processes yields decidedly non-first order kinetics. I.e., this comment supports John's analysis in a general way, but his should be the guiding light.



The individual first order time processes are shown in the straight lines, which are anticipated for semi-log plots. The combined time-trend, however, is decidedly non-linear. One could be fooled into believing the combined curve was first order if only a portion of the curve was visible in the data. A lack of data would not, of course, change kinetics of tissue concentrations. However, using first order kinetics would, in this example, result in overly optimistic estimates of the time frame for achieving RGs. Note that this analysis is intended as an example of how combining first order processes result in complex kinetic profiles that are not first order. The analysis is not suggested for inclusion in the FS.

#### Key Comment 8: Range of PRGs for protectiveness of alternatives evaluation

A range of tissue PRGs are available for use in the FS. All of these PRGs should be used in the evaluation of protectiveness of each alternative. This evaluation should include appropriate modeling of concentrations into the future, resulting in estimate of when, if ever, tissue PRGs might be reached. The analysis should be clear in terms of the target tissue levels achieved at a range of timeframes – e.g., immediately following construction, 10 years following construction and 30 years following construction. This will provide information to allow EPA to select a protective remedy that appropriately balances overall effectiveness with cost consistent with NCP remedy selection criteria. This expression of protectiveness in terms of reaching different levels of sediment concentrations and over what time frames is critical to evaluating the best balance of active remediation and MNR. Note that PRGs based on non-cancer HQs are equally important for PRGs because an HI of 1 is exceeded within EPA's risk range of 10<sup>-6</sup> to 10<sup>-4</sup>.

#### Key Comment 9: Effectiveness of fish advisories

The draft FS over estimates the effectiveness of fish consumption advisories in mitigating risks to human health. Fish consumption advisories have not been shown to be highly effective in reducing angler exposure to toxic chemicals, particularly for high risk populations such as women and minorities. For example, a survey conducted by the Wisconsin Department of Health of fish consumers from the Great Lakes region found limited that only 30% of women, 15% of black sport fish consumers and 52% of all consumers were aware of advisories. A survey of 900 anglers conducted by the Michigan Department of Community of Health (MDCH, 2000) found that less than 50% of anglers were aware of advisories for the Kalamazoo river and 44% consumed fish from the river. The reliance on ineffective fish consumption advisories rather than implementation of meaningful sediment

remediation to reduce risk to human health will result in a site remedy that is not protective of human health. Further, the NCP stipulates that “The use of institutional controls shall not substitute for active response measures (e.g., treatment and/or containment of source material, restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of remedy.”<sup>3</sup>

**Key Comment 10: The rationale used by ARCADIS to substitute more recent core results and calculate mass is flawed and does not reliably represent the mass of PCBs in Area 1**

In reviewing the issues surrounding SWAC calculations, MDEQ reviewers discovered key concerns with mass estimation approach used. The second paragraph of Section 3 of Appendix J of the February 2012 Area 1 SRI document states “Where an original sample location was resampled, the resample core was used for mass and volume calculations. However, when resampling occurred only for surface samples, as a conservative approach the surface-only resample was not used but instead the original whole sediment core was used.” This approach of replacing an old core with a newer one is not appropriate. This is especially the case when the newer core doesn’t get deep enough to analyze the same intervals of the core it’s replacing. One example is at KPT19-3, where full cores were collected in 1993 and 2009

Figure 6-8A of the Area SRI document shows that in 1993 a core was collected at KPT19-3 and analyzed to a depth of 58.8 inches. Two sample intervals were found to contain PCBs >50 ppm, one from 42-54 inches and another from 51-58.8 inches. These results were the reason for additional sampling during the ‘hot spot’ assessment at this transect. The location was subsequently resampled in 2009; however, the total depth of the resample core was only 43 inches deep (and did not get deep enough to resample the TSCA material from the 1993 core). Based on the methodology in Section 3 of Appendix J, the 2009 core from this location is being used for mass/volume calculations (instead of the 1993 core) in Table J-6. Since the 2009 core didn’t penetrate deep enough to resample the TSCA material >42 inches observed in the 1993 core, the mass/volume from this location is being underestimated.

Another mass/volume issue to consider is that many KPT’s collected in 1993/94 were not analyzed past 24 inches. For example, the core at KPT19-5 was only analyzed to 24 inches even though the entire core recovered was 6 feet (and penetrated 7.2 feet). The description for each intervals (from the PROBE table in Arcadis database) was: 0-3 feet GRAY-BROWN FINE TO MEDIUM SAND, TRACE OF ORGANIC MATTER; 3-5 feet DARK GRAY SILT, ORGANIC MATTER, AND FINE SAND; 5-6 feet GRAY CLAY-LIKE MATERIAL WITH SOME FINE SAND. Similarly at KPT19-4, the core was only analyzed to 24 inches, but the entire core recovered went to 5.6 feet (and penetrated 7.1 feet). The core description was 0-3.3 feet GRAY-BROWN FINE TO MEDIUM SAND; 3.3-5.6 feet GRAY AND DARK GRAY SILT-LIKE MATERIAL, POSSIBLE CLAY. The gray silt and clay observed from roughly 3 to 6 feet in both KPT19-4 and KPT19-5 are similar in color and texture as those sampled at KPT19-3 in 1993 that were >50 ppm. Therefore, the mass/volume at KPT19-4 and KPT19-5 are most likely being underestimated. Additional discussions should be held to discuss appropriate “substitution” rules for mass estimating.

<sup>3</sup> 40CFR300.430(a)(1)(iii)(D)

## General Comments

The following general comments are made with respect to the subject document.

- GC 1) The draft Area 1 FS Fails to develop remedial action objectives (RAOs) linked to protective fish tissue concentration that can be used to establish measureable goals towards RAO attainment. RAOs for protection of human health and the environment should focus on reducing fish tissue concentrations to protective concentrations. This point is acknowledged on at the end of the first bullet on Page 1-1 of Appendix E: In order to effectively achieve RAOs 1 and 2, fish PCB concentrations must be reduced to mitigate the exposure pathway to anglers and their families as well as fish-eating birds and other mammals. Consistent with previous comments on the Alternatives Screening Technical Memorandum (ASTM), RAOs 1 and 2 should be revised to read:

"RAO 1: Reduce to acceptable levels the cancer risks and non-cancer health hazards for people eating fish from the Kalamazoo River by reducing the concentration of PCBs in fish."

"RAO 2: Reduce to acceptable levels the risks to local populations of fish eating birds and mammals by reducing the concentration of PCBs in fish."

- GC 2) A range of fish tissue concentrations based remedial goals for sediments should be developed based on a the results of the baseline human health and ecological risk assessments, Michigan Department of Community Health (MDCH) fish consumption advisories and back ground levels of PCBs in fish tissue as measured in Ceresco Reservoir. Based on information presented in Tables 1 through 3 below, target tissue levels on the order 0.04 mg/kg for smallmouth bass and 0.2 mg/kg for carp should be established to ensure protection of human health and the environment, eliminate fish consumption advisories to the extent practicable and be consistent with EPA's background policy. (Fish tissue levels relevant to the selection of target tissue levels are highlighted in green.) It is likely that such tissue levels will not be reachable for many years (30+ years); thus, these targets should be considered as long-term and should be revisited at five-year intervals to determine if MNR might reach these goals within 30 years.

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Milt Clark January 24, 2013 3:17 PM The 10 year target language worked out with EPA should be placed here. If 0.33 ppm SWAC gives heartburn, then put other risk based value close to it.

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say these tissue goals targeted at 30 years post remediation

**Table 1 Protective Fish Tissue Levels**

Exposure Scenario	Consumption Rate	Risk Level	Protective Fish Tissue Concentration Smallmouth Bass (100 % of diet)	Protective Fish Tissue Concentration Mixed Diet Carp (24% of diet) *	Protective Fish Tissue Concentration Mixed Diet Smallmouth Bass (76% of diet) *
Protection of Human Health					
Central Tendency Sport Angler	15 g/day	HQ = 1	0.19 mg/kg	0.39 mg/kg	0.12 mg/kg
		1 x 10-5	0.11 mg/kg	0.23 mg/kg	0.072 mg/kg
High End Sport Angler	78g/day; 50% from site	HQ = 1	0.072 mg/kg	0.15 mg/kg	0.047 mg/kg
		1 x 10-5	0.042 mg/kg	0.87 mg/kg	0.028 mg/kg
Subsistence Angler	110 g/day	HQ = 1	0.025 mg/kg	0.053 mg/kg	0.017 mg/kg
		1 x 10-5	0.015 mg/kg	0.031 mg/kg	0.010 mg/kg
Protection of Ecological Receptors					
Ecological Receptor		Risk Level	Target Tissue Level		
Mink		EC10	0.5 mg/kg		
		EC25	0.6 mg/kg		

\* Mixed diet scenario assumes equal contribution of risk from smallmouth bass and carp based on the assumption that the diet weighted protective tissue concentration is equal to the acceptable tissue level assuming a diet of 100% smallmouth bass (e.g.,  $(0.15 \times 0.24) + (0.047 \times 0.76) = 0.072$ ).

**Table 2 - Michigan Department of Community Health Fish Advisory Levels**

Consumption category	PCB fish tissue levels
<b>General Population</b>	
One meal a week	10% of the fish tissue levels for a particular species and length are above 2.0 ppm
Do not eat	50% of the fish tissue levels for a particular species and length are above 2.0 ppm
<b>Sensitive Population</b>	
Unlimited	less than 0.05 ppm
One meal a week	0.05 ppm to less than 0.2 ppm
One meal a month	0.2 ppm to less than 1.0 ppm
Six meals a year	1.0 ppm to less than 1.9 ppm
Do not eat	1.9 ppm and above



Table 3 PCB Fish Tissue Levels – Ceresco Reservoir

Species	Year	PCB Tissue Level (mg/kg)	
Yearling Smallmouth Bass	1999	0.15	5
Adult Smallmouth Bass		0.03	11
Adult Carp		0.1	11
Yearling Smallmouth Bass	2000	0.16	5
Adult Smallmouth Bass		0.05	11
Adult Carp		0.2	11
Yearling Smallmouth Bass	2001	0.10	5
Adult Smallmouth Bass		0.04	11
Adult Carp		0.4	11
Yearling Smallmouth Bass	Average	0.14	15
Adult Smallmouth Bass		0.04	33
Adult Carp		0.2	33

GC3) The draft FS presents a limited set of remedial action alternatives, the majority of which do not result in appreciable risk reduction. Information presented in Table E-2 demonstrates that only Alternative 6 may achieve protective levels within EPA's risk range under all scenarios. Furthermore, Alternatives 3A/B, 4A/B and 5A/B are indistinguishable from one another and do not achieve appreciable risk reduction in comparison to Alternatives 1 (No Action) and 2 (MNR). As summarized in Table 4 and Figures 1 and 2 below demonstrate that only Alternative 6 shows any appreciable reduction in tissue levels and associated risk to human health and the environment. Note that these results are based on unrealistic time trend analysis, and the most optimistic estimates of time-to-target tissue concentrations are measured in many decades. It should be noted that the analysis presented below is based on the analysis presented in the draft FS which is based on non-lipid normalized tissue data. As presented in other MDEQ comments, a significant portion of the observed reduction in tissue levels is due to reductions in lipid content. As a result the assumptions of risk reduction presented in Table 4 and Figures 1 and 2 below are over estimated. This suggests that remedial action alternatives that target the hot spots are likely to result in negligible risk reduction and will not achieve EPA's threshold protectiveness criteria under the NCP.

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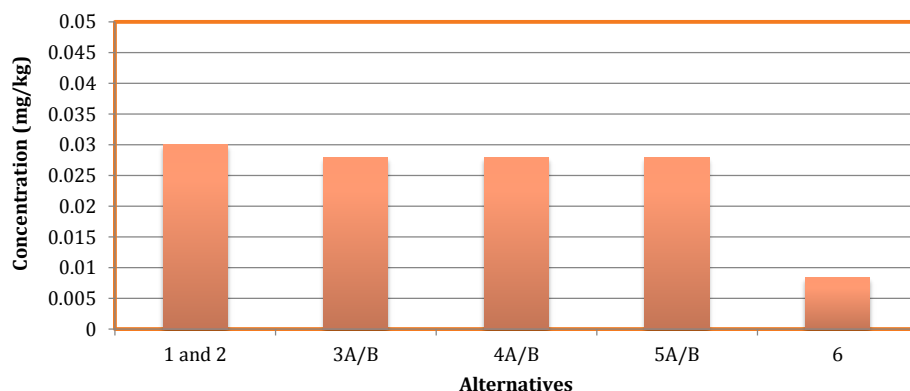
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Milt Clark January 24, 2013 3:17 PM Need to state that these predictions are not correct

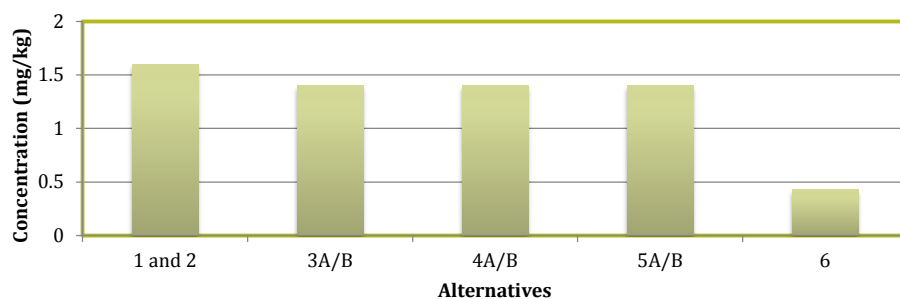
Table 4 – Predicted Tissue Levels

Alternative	Predicted Bass PCB Concentration t=30 years (mg/kg)	Predicted Carp PCB Concentration t=30 years (mg/kg)
Alternatives 1 and 2	0.030	1.6
Alternative 3a/b	0.028	1.4
Alternative 4a/b	0.028	1.4
Alternative 5 a/b	0.027	1.4
Alternative 6	0.0084	0.43

**Figure 1 – Predicted Smallmouth Bass PCB Tissue Levels  
(T= 30 years)**



**Figure 2 – Predicted Carp PCB Tissue Levels  
(T= 30 years)**



- GC 4) The draft Area 1 FS fails to evaluate a sufficient range of remedial action alternatives. As demonstrated in Figures 1 and 2 above, the hot spot alternatives are indistinguishable from one another in terms of reductions in fish tissue levels and associated risk reduction. As a result, MDEQ recommends that Alternatives 3A/B, 4A/B and 5A/B be combined into a single remedial action alternative that addresses sediment hot spots within Area 1 of the Kalamazoo River. In addition, two additional remedial action alternatives should be incorporated into the FS. Figures 3 and 4 suggest that remedial action alternatives that target sediment remedial action levels of 5 mg/kg and 10 mg/kg total PCBs will provide additional information to support EPA's remedy decision process.

Figure 3 (Figure 5-12 from draft Area 1 FS revised to present RALs on a linear scale)

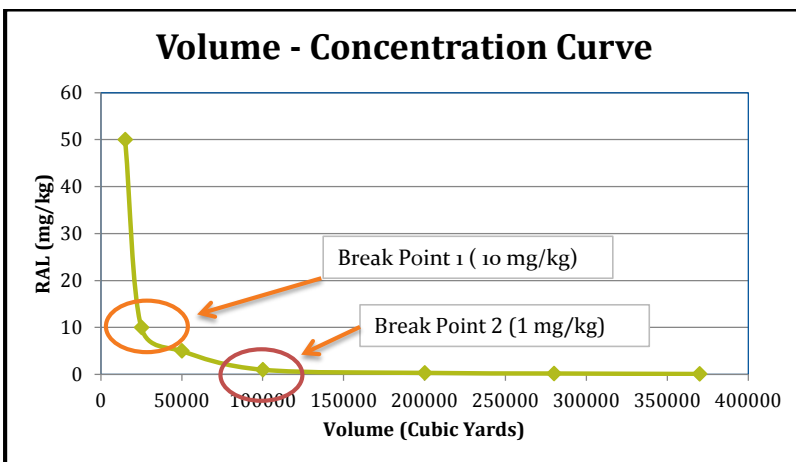
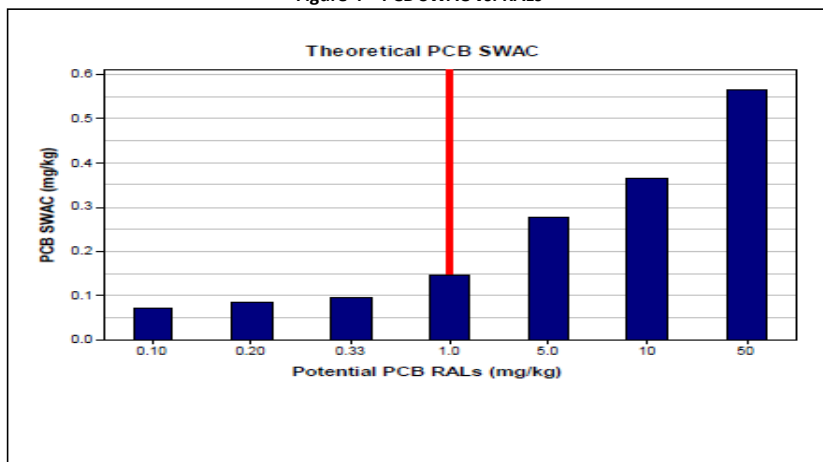


Figure 4 – PCB SWAC vs. RALs



- GC 5) The draft Area 1 FS should include a remedial action objective that focused on minimizing the erosion of PCB contaminated floodplain and river bank soils to the Kalamazoo River. This RAO is needed to allow evaluation of the institutional controls focused on erosion control in the evaluation of floodplain soil remedial alternatives and to ensure that sediment remedies implemented at the site do not become re-contaminated due to floodplain soil and river bank erosion. Recommended RAO language is as follows:

RAO 5: Reduce transport of PCBs from river bank and flood plain soils to the Kalamazoo River. This RAO is intended to reduce the rate of transport of PCBs from river bank and flood plain soils to the Kalamazoo River at levels that pose risk to human health or the environment.

GC 6) The draft Area 1 FS should include updated analyses to support the evaluation of remedial action alternatives.

- Updated evaluation of trends in tissue levels based on mixed order analysis. This analysis provides a better estimate for a decay constant (k) for evaluating a decreasing trend in PCB concentrations over time. This estimate, for smallmouth bass, is substantially less than the estimate used in the RS. Trends in fish tissue PCB concentrations can be estimated using first order kinetics as a short-cut, but must use a realistic estimate of k that recognizes the decreasing slope of the decay curve over time. A value of about 2% is defensible and fits both available data and the current model for kinetics of PCBs in aquatic systems. and lipid normalized fish tissue resultsBased on analysis performed by MDEQ, tclearly d the expected reduction in smallmouth bass carp PCB tissue levels.
- Updated tissue sediment relationships to support development of sediment based cleanup levels. Based on relationships developed at other sites using BSAFs and food-web models, the current relationship may overestimate the PCB sediment concentration necessary to reduce tissue levels to protective concentrations. The FS should develop and present sediment-tissue relationships based on biota-sediment accumulation factors (BSAFs) or a simple food web model. MDEQ has developed an empirically derived tissue-sediment relationship that considers tissue concentration, lipid content, fish length, sediment concentration, sediment TOC, and water concentration. Protective fish tissue concentrations should be used to estimate the sediment concentrations that must be achieved to achieve the protective tissue levels.
- Breaking site into river reaches to facilitate the selection of a cost effective and protective sediment remedy that targets areas where PCB levels are highest based on the conceptual site model.

GC 7) The majority of the remedial action alternatives (3a, 3b, 4a, 4b, 5a and 5b) focus on active remediation of PCB sediment "hot spots". However, the information presented in the FS (Appendix E) demonstrates that these alternatives do not achieve meaningful risk reduction and reduction of fish tissue levels and will not meet the threshold criteria of protectiveness. This conclusion holds even though the rate constant used in the FS is overly optimistic. Alternative 6, which targets PCB concentrations above 1 mg/kg appears to achieve meaningful risk reduction. For example, Table E-2 shows that alternative 5a and 5b will achieve tissue levels of 0.027 mg/kg in smallmouth bass and 1.4 mg/kg in carp after 30 years. This time frame overestimate time to reach acceptable tissue concentrations, as discussed above. It is more likely that tissue concentrations will decline more slowly and protective tissue concentrations may not be reached for several decades.

GC 8) Bass and carp concentrations of 0.27 and 1.4 predict health risks are within EPA's cancer risk range, but exceed MDEQ's  $1 \times 10^{-5}$  risk standard and the non-cancer risk threshold for both the central tendency and high end sport angler scenarios. However, Alternative 6 is predicted

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to achieve PCB tissue levels of 0.0084 for smallmouth bass and 0.43 mg/kg for carp. This equates to a lifetime excess cancer risk level of  $3.86 \times 10^{-6}$  and HQ of 2.14 (immunological endpoint) for the high end sport angler and a lifetime excess cancer risk level of  $1.41 \times 10^{-6}$  and A HQ of 0.82 is estimated (immunological endpoint) for the central tendency end sport angler. These levels are within EPA's cancer risk range and approach protective levels based on MDEQ's  $1 \times 10^{-5}$  risk standard while meeting the non-cancer risk threshold for the central tendency scenario while approaching the non-cancer risk level for the high end sport angler scenario. In addition, Alternative 6 is predicted to be protective of ecological receptors as shown in Table E-9.

GC 9) A fully successful sediment remedy typically is one where the selected sediment chemical or biological cleanup levels have been met and maintained over time, and where all relevant risks have been reduced to acceptable levels based on the anticipated future uses of the water body and the goals and objectives stated in decision documents (Ex. Sum, page V).

GC 10) Project managers are encouraged to use the concept of comparing net risk reduction between alternatives as part of their decision-making process for contaminated sediment sites, within the overall framework of the NCP remedy selection criteria (7-13)

GC 11) Both 10 and 30 year remediation goals based upon acceptable PCB levels in fish need to be developed. Reasonable short term goals would be 0.20 ppm SMB, 10-5 risk, and HI of 1.0 for bass consumers. Reasonable long term goals would be 0.04 ppm for SMB (or elimination of bass advisories as targeted for the Fox River ROD) and 0.2 ppm for carp, the later to protect 24% of the population determined to consume carp by the 1998 MDCH survey of anglers.

GC 12) Sediment remediation alternatives have not been sufficiently developed or explained to support FS decision-making. Although requested by both MDEQ and U.S. EPA the remedial alternatives were not developed based upon a range of PCB RALs (0.1, 0.2, 0.33, 1, 5, 10, and 50 mg/kg). Only 50 ppm and 1 ppm RALs were fully evaluated giving wide ranges (Sed-5B, 5 acres and 18,000 cy and Sed-6, 79 acres and 110,000 cy). As a result, the FS has intentionally been developed to give the false appearance that a RAL of 1 ppm and 110,000 cy appears unreasonable. A 5, 2 and 10 ppm RAL need to be fully developed.

GC 13) The FS places inappropriate emphasis on fish consumption advisories to provide long term protection of public health, which is inconsistent with decision making at major recent Superfund sediment sites. Fish consumption advisories have not been shown to be highly effective in reducing angler exposure to toxic chemicals, particularly for high risk populations such as women and minorities. Special concern is for populations that have a cultural background that includes a high intake of fish and for those with English as a second (or non-existent) language. These populations tend to be ones that may not participate in surveys, or unaware of fish advisories, or do not follow them. For example, a survey conducted by the Wisconsin Department of Health of fish consumers from the Great Lakes region found limited that only 30% of women and 15% of black sport fish consumers were aware of advisories. Only 52% of all fish consumers followed fish consumption advisories. (Imm, P. Knobeloch L, Anderson HA.) Fish consumption and advisory awareness in the Great Lakes Basin. Environ Health Perspect. 2005 Oct;113(10):1325-9. The FS relies on RP evaluations (Aiken, 1994, 1998; Stratus, 2001) regarding angler behavior on Kalamazoo River and fails to discuss the largest survey of over 900 anglers conducted by the Michigan Department of Community of Health (MDCH, 2000). This survey found that less than 50% of anglers were aware of

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advisories for the Kalamazoo river and 44% consumed fish from the river. Those who consumed Kalamazoo river fish had elevated levels of PCBs as compared to those who did not consume Kalamazoo river fish, consistent with several Great Lake studies demonstrating PCB exposures via fish consumption (Johnson B.L., et al, Key Environmental Health Issues in the Great Lakes and St. Lawrence River Basins, Environmental Research, Vol 80 (2), S2, 1999; and Johnson, B.L., et al, Public Health Implications of Exposure to PCBs, Agency for Toxic Substances and Disease Research, Centers for Disease Control, HHS, 2008).

The FS fails to discuss known adverse human health impacts (e.g., neurobehavioral impacts, endocrine/thyroid effects, immune effects, diabetes, etc.) associated with PCB exposures, including those from fish consumption. (Toxicological Profile for PCBs, ATSDR, CDC, 2000. <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=142&tid=26>; Toxicological Profile for PCBs, Addendum, 2011). Therefore, the document does not provide an acceptable understanding of human health risks and how alternatives will provide protection of public health.

- GC 14) Area I needs to be broken down into smaller segments to evaluate existing contamination and how remedial actions in these smaller segments will reach risk based SWACs. This approach will allow development of remedial action alternatives that target sediment remediation on the areas where it will do the most good (i.e., greatest degree of risk reduction).
- GC 15) The Kalamazoo River Superfund is very similar to the Tittabawassee River Superfund site in that contaminant sources areas include contaminated lagoons, point sources discharge, banks, floodplains and sediments. At the Tittabawassee River site, EPA has developed risk based targets following remediation. Experts from the EPA-Dow Chemical Statement of Work (Sow) are presented below.

#### 10.2. Segment-Specific Post-Construction Residual Risk Assessment

*The Respondent shall conduct a human health and ecological risk assessment based on post- construction and/or Site-wide Monitoring (Task 4) data in accordance with the requirements of SOWSectionVII1.D. In order for response efforts at a particular segment to be considered complete, the residual risk analysis shall demonstrate that residual human health and ecological risk falls within ranges considered by EPA, in consultation with MDEQ, to be acceptable.*

*If EPA, in consultation with MDEQ, determines:*

*The residual risk analysis for both short-term RAOs and long-term RAOs demonstrates 'that residual human health and ecological risk falls within an acceptable risk range, then the response efforts at that particular segment (excluding ongoing operation, monitoring and maintenance) will be considered complete, pending a final OU 1 ROD.*

*The residual risk analysis for short-term RAOs demonstrates that residual human health and ecological risk falls within an acceptable risk range, but that the residual risk analysis for long-term RAOs demonstrates that residual human health and/or ecological risk does not fall within an acceptable risk range, then the Respondent shall:*

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*Conduct an analysis assessing whether residual contaminant levels in sediments, banks, and/or floodplain soils are likely to result in acceptable risk for the long-term RAOs in a reasonable period of time (e.g., predict future fish levels by use of site-specific BSAFs, predictive modeling, etc.);*

*To the extent possible, and given the uncertainties about response decisions in other segments, predict the time until the long-term RAOs may be attained;*

*Continue monitoring in accordance with approved plans; and Submit a Multi-Segment, OU-Wide, and/or Site-Wide Post-Construction Risk Assessment in accordance with sub-task 10.3.*

*The residual risk analysis for short-term RAOs demonstrates that the residual risk does fall within an acceptable risk range, then the Respondent shall submit a new Segment-Specific Response Proposal that addresses sub-tasks 8.3 and 8.4 and a new RD pursuant to Task 9, in accordance with the Schedule in Exhibit B of this SOW.*

## Specific Comments

- SC 1) ES -1 . The Executive Study (ES) states that the purpose of the FS is to “identify what, if any, actions are needed to further reduce remaining risks in Area 1.” Given that risks unacceptable risks are present within Area 1, the qualifier “if any” should be eliminated.
- SC 2) ES-2: The draft FS fails to sufficiently explain why hydraulic dredging or dry excavation was eliminated from evaluation in the FS.
- SC 3) ES-4: The ES states that approximately 650 kg of PCBs are present within Area 1. The ES should note that this is an estimate based on the characterization of contaminated sediments presented in the RI Report. Given the scale of characterization at the site (e.g., ¼ mile transects throughout much of Area 1,) this estimate is uncertain and further refinement of areas and volumes of contamination may be required during remedial design.
- SC 4) ES-5: The ES provides an estimate of the SWAC for all of Area 1. However, the ES- also describes the prevalence of hot spots within the reach between RM 68.4 and 72.4 which is an area of lower gradients, thicker sediment deposits and higher PCB levels. The ES should include an estimate of the SWAC for this reach, as well as other reaches), in addition to the Area 1 SWAC.
- SC 5) ES-5: The ES states: “With steady flow conditions and dynamic equilibrium, significant movement of PCBs from buried sediments to the bioavailable surface sediments and water column is not anticipated to occur under normal flow regimes.” Given that the sediment bed is in “dynamic equilibrium” it is expected that the sediment bed is continually being reworked such that contaminated sediments are covered with new material and re-exposed on a regular basis. As a result, the statement that movement of PCBs from buried sediments to surface sediments is not anticipated to occur contradicts the statement regarding dynamic equilibrium.

- SC 6) ES-5: The presentation of fish tissue trend data over states the decline in fish tissue levels. For example, for smallmouth bass, data collected in 2006, 2009 and 2011 do not show an appreciable decline in tissue levels. Reductions in carp data are even less apparent over a longer time frame. These data suggest that natural attenuation of fish tissue levels is unlikely to achieve protective concentrations within a reasonable time frame. This is in sharp contrast to the Bryant Mill Pond fish tissue monitoring data which show a significant decline in PCB tissue levels in response to an aggressive sediment removal action.
- SC 7) ES-6: MDEQ has previously commented on the RAOs presented in the Alternative Screening Technology Memo. However, these comments have not been incorporated into the RAOs presented in the draft FS. Of particular concern is RAO 1. RAO 1 should focus on reducing PCB levels in fish tissue to acceptable levels rather than reducing risks through reliance on fish consumption advisories. A similar concern is noted for RAOs 2 and 3. These RAOs should also focus on reducing fish tissue and soil concentrations to concentrations protective of ecological receptors.
- SC 8) ES-6: The PRG of 0.33 mg/kg is not risk based, does not reflect current detection capabilities for PCB analysis and thus is of limited utility as a PRG.
- SC 9) ES-6: Long-term SWAC goals must be based on considerations such as home range and the area over which exposure is expected to occur.
- SC 10) ES-7: While the removal of contaminated sediments targeted hot spot areas “provides an opportunity to reduce the inventory of remaining sediment PCB mass within Area 1,” the degree of risk reduction achieved by these removal actions is minimal in comparison to the no action and monitored natural recovery alternatives and is not expected to achieve protective fish tissue levels for the mixed diet, high end sport angler and subsistence angler exposure scenarios (See Figures E-3a and E3c from the ASTM).
- SC 11) ES-7: PCB PRGs of 11 and 18 mg/kg were selected for the evaluation of remedial actions alternatives targeting floodplain soils. However, these PRGs exceed the PRGs for certain terrestrial ecological receptors such as the woodcock which requires a target soil concentration of 5 mg/kg to ensure protectiveness (See Figure 2-11). The FS should document how the various floodplain alternatives are protective of terrestrial receptors with PRGs below 11 mg/kg such as the woodcock.
- SC 12) ES-8: The sediment alternatives evaluated do not represent an appropriate range of alternatives for the purpose of remedial action decisions. Alternatives 3A, 3B, 4A, 4B, 5A and 5B should be combined into a single alternative targeting hot spots. In addition, three additional alternatives targeting RALs of 2 mg/kg, 5 mg/kg and 10 mg/kg total PCBs should be included in the revised FS (See General Comment 4). In order to facilitate the selection of a remedy that is consistent with the cost effectiveness requirements specified in the NCP, alternatives that target RALs of 1 mg/kg, 5 mg/kg and 10 mg/kg total PCBs should be developed on a reach specific basis (See General Comment 5). This will result in the elimination of certain reaches from consideration. It should be noted that the RALs evaluated in the FS are for the purpose of remedial decision making. It is expected that further refinement of the areas of sediment requiring remediation will occur during remedial design.



- SC 13) ES-8: The floodplain alternatives should include intermediate remedial action alternatives between the selected 20 mg/kg and 1 mg/kg RALs to ensure that a full range of floodplain soil remedial action alternatives are evaluated in the FS
- SC 14) ES-11: The ES states that ongoing Site-wide natural recovery processes are expected to reduce sediment concentrations and PCB levels in fish. However, the FS did not evaluate trends in sediment levels. Further, because the sediment bed is in “dynamic equilibrium” the degree to which sediment levels are expected to decline is unclear. Finally, as stated above, empirical data suggests that ongoing reductions in tissue levels are not likely to achieve protect concentrations within a reasonable timeframe.
- SC 15) ES-12: MDEQ acknowledges the need for continued fish consumption advisories until such time that protective fish tissue concentrations are achieved. However, the limited effectiveness of fish consumption argues for remedial actions that result in a rapid reduction if fish tissue levels.
- SC 16) ES-12 and 13: The time to achieve protectiveness summarized in this section and presented in Table ES-4 is based on fish tissue trend data that overstates the expected decline in fish tissue levels. However, even based on these over optimistic estimates of fish tissue declines, mixed diet exposure scenarios do not achieve the MDEQ cancer risk threshold of  $1 \times 10^{-5}$  within 30 years for any alternatives and with the exception of Alternative SED-6, do not achieve non-cancer protective levels within 30 years.
- SC 17) ES-14: The ES states: “Among the alternatives that target hot spots (i.e., SED-3A/3B through SED-5A/5B), there is little gained in terms of SWAC and risk reduction for those alternatives that address a greater number of hot spots and associated PCB mass.” MEQ agrees with this statement and believes that it argues for the inclusion of additional remedial action alternatives to provide EPA with an adequate range of remedial decision options.
- SC 18) ES-18: MDEQ disagrees with the assertion that all the floodplain soil alternatives are equally reliable to maintain protectiveness. With the exception of alternative FP-7, the alternatives do not achieve soil concentrations protective of local populations of woodcocks. In addition, the application of institutional controls is not expected to reduce ecological risks appreciably.
- SC 19) Page 1-4: See previous comments regarding RAOs (General Comment 1, Specific Comment 6 - page ES-6).
- SC 20) Page 1-5: See previous comments regarding sediment alternatives.
- SC 21) Page 1-6: See previous comment regarding soil alternatives.
- SC 22) Section 2, Page 2-1, first bullet. Remove the phrase “Due to conservatism and uncertainty associated with RBC calculations, exceedances of the lower range of RBCs do not necessarily indicate that receptors are not protected.” The FS document does not determine protectiveness.
- SC 23) Page 2-1, Section 2.1, first paragraph. The two scenarios described are not sufficient for evaluation of alternatives for Area 1, as discussed in general comments. These scenarios are insufficient to inform decisions on the relationship between active removal and time to reach protective targets.

SC 24) Page 2-2, first paragraph, Section 2.1.1. The sentence “While the RBCs presented in the prior Site-wide risk assessments (CDM 2003a, 2003b) are not cleanup criteria, they are an approximation of protective sediment values and can be considered “working values” from which to select a PRG” implies that a single PRG must be selected for evaluation of alternatives. This implication is incorrect. As discussed in general comments, protectiveness can and should be evaluated against a range of clean-up criteria associated with different exposure scenarios, target risks and HQs.

SC 25) Page 4-8, Section 4.1.2.2 The monitoring program described in the following bullets,

- Fish monitoring once every three years for three events and then reduced to once every five years at three locations (two species at each of two locations within Area 1 and one background location – with about 70 fish collected in total) with samples submitted for PCB and lipid analysis.
- Verification of institutional controls annually.

is considered inadequate as currently described. Proposed fish monitoring is unlikely to be sufficient to support verification of modeling predictions, determine effectiveness of MNR and reduce uncertainties in estimates of time frame for reaching remediation targets. Fish sampling should be included for each of the RI river segments at several locations at least every two years. The exact nature of monitoring should not be included in the FS. An estimate of costs should be taken from previous RI field estimates.

Also, it is completely unclear how institutional controls (fish advisories) will be “verified”.

Some current information suggests that fish advisories are not especially effective in preventing consumption of contaminated fish. Does verification in this case simply mean that someone will check to see if notices are in place once a year? Or will angler surveys be conducted?

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Milt Clark Jan 24, '13, 3:20 PM  
The point was already made on fish advisories, so we can drop this paragraph. We don't want the RPs doing angler surveys.

SC 26) Page 2-2: The PRG of 0.33 mg/kg is not risk based and therefore is not an acceptable PRG for sediment remediation. MDEQ considers the high end sport angler as the RME exposure scenario for human health. Based on the information presented in Figure 2-1, PRGs that should be incorporated into the revised FS are 0.12 mg/kg (mixed diet;  $1 \times 10^{-5}$  risk level) and 0.2 mg/kg (mixed diet; HQ=1).

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Milt Clark Jan 24, '13, 3:22 PM Need to distinguish between recreational and subsistence. Lets cite sed values for the high end bass.

SC 27) Page 2-2: The PRGs presented are sediment PRGs that are expected to result in acceptable fish tissue levels. However, the analysis used to develop sediment-tissue relationships are not presented, discussed or summarized. Information regarding the development of these relationships should be presented and the uncertainties in this analysis discussed. Due to the uncertainty in these estimates and the likelihood that sediment remediation activities (e.g., dredging) will perturb the system, target tissue levels for projection of human health and the environment should also be included in the revised FS.

SC 28) Page 2-2: The sensitivity analysis used to support the selection of RALs described here and presented in the ASTM included figures 5-12 and 5-13 which present the RALs on log scale. Presenting this information on a normal scale allows the break in curve to be identified more readily. Based on the volume concentration curve presented in General Comment 4 above, it is clear that there are diminishing returns in evaluating RALs below 1 mg/kg. However, the

evaluation also shows that there considering RALs of 10 mg/kg and 5 mg/kg should provide useful information to support remedial decision making.

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Milt Clark Jan 24, '13, 3:24 PM Language here....perhaps include value of 2 here and elsewhere since John is considering

- SC 29) Page 3-3. Under the NCP, the evaluation of short-term effectiveness includes the time to achieve protection. Although this is noted in the section, it should be highlighted that alternatives that rely on MNR must also consider the time to achieve protection (not just alternatives that involve active remediation as the discussion implies).
- SC 30) Page 4-4: Figure 4-1 indicates that approximately 60% of the PCB sediment mass is present between RM 68 and 73. Developing a series of alternatives that rely on RALs of 5 mg/kg and 10 mg/kg total PCBs and target this reach of the river may result in a site remedy that is cost effective and achieves protectiveness within a reasonable time frame.
- SC 31) Page 4-5: The draft FS Report states that "completion of the TCRAs, continued decline of upstream contributions, and further reduction in loading of PCBs to the river from external sources have resulted in significant reductions in water column PCB concentrations." However, the analysis presented in Appendix E estimated an incoming PCB sediment concentration of 67 ug/kg (based on an upstream surface water concentration of 1 ng/L and a TSS concentration of 15 mg/kg and assuming that all the PCB within the water column is associated with suspended particulates). Based on this evaluation, it may be that a sediment concentration of 67 ug/kg may be lowest sediment concentration reasonably achievable. The FS should evaluate the degree to which this concentration is in the range of sediment concentrations protective of sport anglers at the Kalamazoo River site.
- SC 32) Page 4-6. The draft FS notes that the sediment bed is in "dynamic equilibrium" and that high flow events sufficient to remobilize buried sediments are not likely. However, not information to support this assertion is provided. As stated in Specific Comment 5 (Page ES-5), given that sediments are in dynamic equilibrium suggests that sediments are continually being reworked and that permanent burial of contaminated sediments is unlikely.
- SC 33) Page 4-18. The draft FS notes that MNR in conjunction with the sediment removal and source control activities is expected achieve RAO 1. However, the analysis presented in Appendix E, indicates that protective fish tissue PCB concentrations are unlikely to be achieved based on the high end sport angler and mixed bass and carp diet. As a result, MNR is not effective as a standalone remedy and cannot achieve protectiveness without application of institutional controls in conjunction with MNR.
- SC 34) Page 4-19. The draft FS estimates the Area 1-wide SWAC as 0.55 mg/kg. However, higher SWACs exist within certain reaches of the site. Given the home range of smallmouth bass (on the order of one mile), the use of a site-wide SWAC may not be meaningful from the standpoint of reducing bass tissue levels within specific reaches of the site.
- SC 35) Page 4-24. The removal action performed at Bryant Mill Pond as well as the sediment removal activities underway at the Fox River site suggest that removal of contaminated sediment through dredging or excavation can be an effective mechanism for rapidly reducing tissue levels. This is particularly true at the Kalamazoo River site where capping may not be implementable due to water depth, water velocities, navigational concerns and where sediments are continually reworked in a dynamic equilibrium environment. Some of the

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Milt Clark Jan 24, '13, 3:26 PM  
Do we really want them to evaluate the 0.067 ppm value?...I would drop this comment as it takes focus off of Kern's work

issues with dredging may be overcome through managing residuals by backfilling with sand immediately following completion of dredging activities within a given area or reach and installing sheet pile to allow excavation techniques as was accomplished at the Housatonic River site.

- SC 36) Page 4-26. Under the NCP, short term effectiveness includes an evaluation of the time to achieve protection. This should be included as an evaluation criteria for MNR at Kalamazoo River site.
- SC 37) Page 4-44. Table 4-5 provides estimates of sediment volumes that would be subject the Toxic Substances Control Act. For Alternative SED-6, this volume is estimated as 25,000 cy (adjusted) and 150,000 cy (unadjusted). Given that the removal threshold is 1 mg/kg (considerably less than the TSCA threshold of 50 mg/kg), this estimate appears grossly inflated. At a minimum, the justification for this estimate should be provided.
- SC 38) Page 4-46. Regarding Figure 4-7, there is little appreciable difference between the alternatives evaluated based on the 100% smallmouth bass diet. The results of this analysis are strongly influenced by the estimated rate of decline in smallmouth bass tissue levels. However, as noted in Specific Comment 5 (Page ES-5), smallmouth bass tissue data collected in 2006, 2009 and 2011 do not show an appreciable decline in tissue levels. It should also be noted that for mixed diet case, alternative SED-6 shows a marked improvement over the alternatives from for the non-cancer immunological endpoint and would also show a significant improvement for cancer risk if those estimates were calculated out beyond 30 years.
- SC 39) Page 4-47. Regarding residuals, the placement of a thin layer to manage residuals should be put in place as soon as is practicable following dredging activities to minimize downstream transport of PCB contaminated material and improve short term effectiveness.
- SC 40) Page 5-12. MNR is a component of many of the floodplain alternatives. The primary MNR mechanism is "occasional inundation of the floodplain would lead to deposition of cleaner sediments carried by floods." However, no information regarding the rate of deposition or the time to achieve protective concentrations through floodplain MNR is provided. At a minimum, information regarding the frequency of inundation, the average thickness of newly deposited sediments and the concentration of incoming sediments is required to evaluate the effectiveness of MNR in achieving floodplain soil RAOs.
- SC 41) Page 5-13. The FS describes an institutional control designed to minimize erosion to the Kalamazoo River. The institutional control is described as a series of Administrative Orders on Consent and a Consent decree which specify requirements for the long-term monitoring, maintenance and stability of the river banks to prevent remaining PCB-containing bank soils in restored areas from entering the river. MDEQ agrees that minimizing erosion of PCB contaminated material to the Kalamazoo River is a key element for maintaining long term effectiveness and permanence of in water remedies. As result, MDEQ recommends that an additional RAO be included in the FS that addresses the riverbank erosion migration pathway:

RAO 5: Reduce transport of PCBs from river bank and flood plain soils to the Kalamazoo River. This RAO is intended to reduce the rate of transport of PCBs from

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Milt Clark Jan 24, '13, 3:28 PM Updated per Kern's findings

river bank and flood plain soils to the Kalamazoo River at levels that pose risk to human health or the environment.

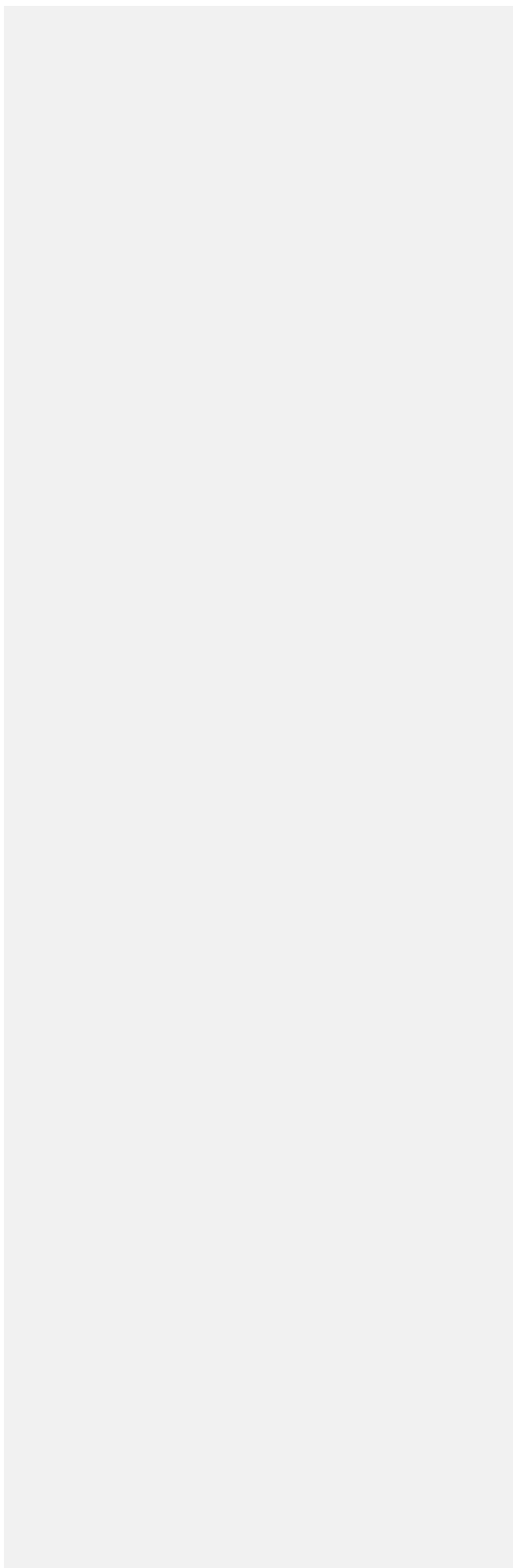
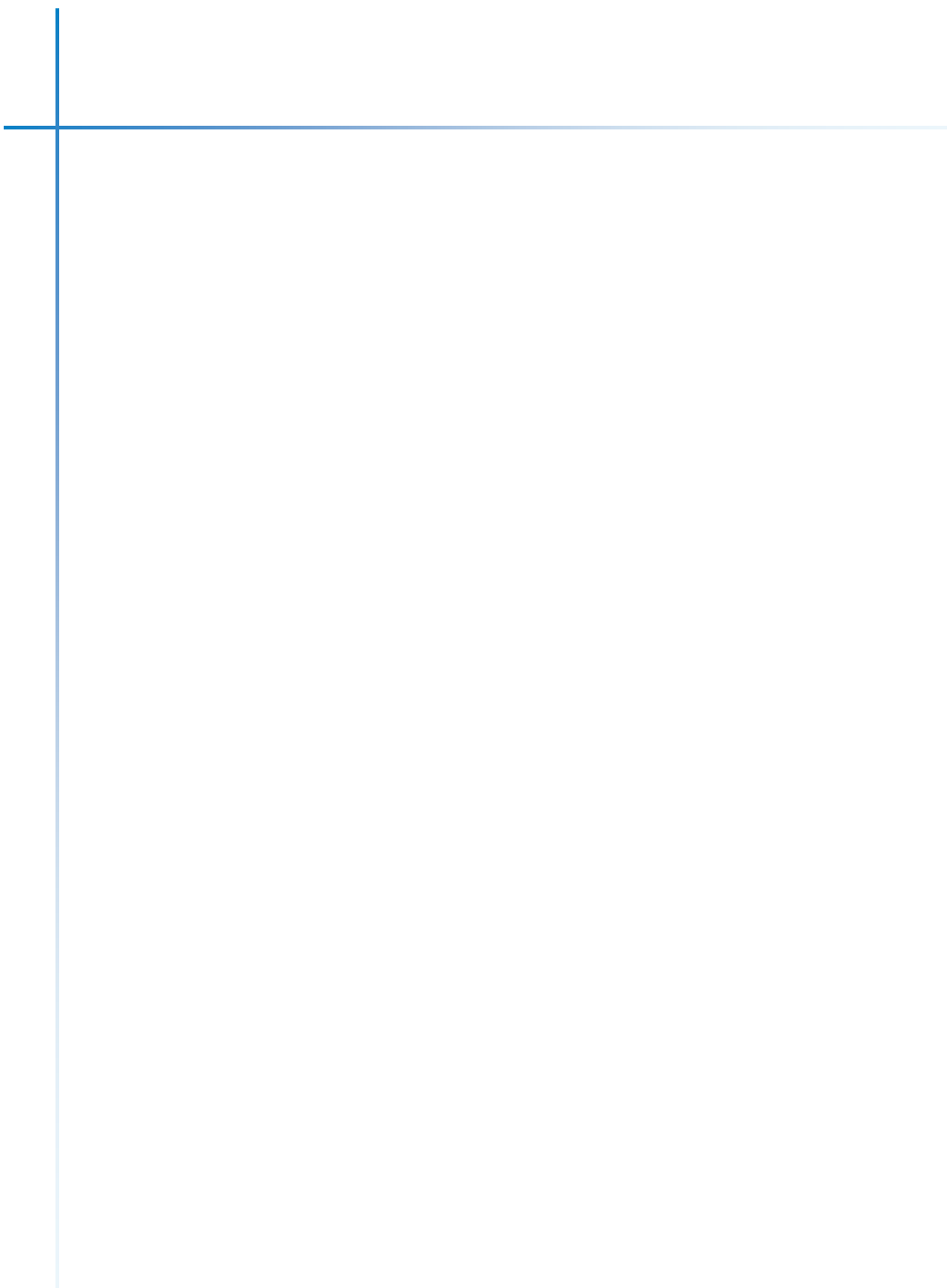
Institutional controls such as those described in this section of the FS can then be evaluated against the above RAO.

- SC 42) Page 5-13. Remedial technologies that involve the placement of backfill, soil caps or soil covers should include provisions for the planting of a vegetative cover to restore habitat disturbed during implementation of the remedy and to minimize erosion of the backfill, soil cap or soil cover.
- SC 43) Page 5-15. Erosion control efforts are described as “specific to bank soils only and includes placement of soft armoring materials and/or vegetative cover following removal with backfill or cap/cover placement.” As stated in Specific Comment 36, above, these erosion control efforts should be evaluated and monitored with respect to attainment of the recommended RAO 5 – Reduce transport of PCBs from riverbank and floodplain soils to the Kalamazoo River.
- SC 44) Page 5-20. Consistent with the NCP, the evaluation of short-term effectiveness must include the time to achieve protection. This criteria is key to the evaluation of MNR.
- SC 45) Page 5-25. MDEQ does not agree that “alternatives which do not involve further soil remediation, FP-1 and FP-2, satisfy the criterion of overall protection of human health and the environment.” Based on the PRGs presented in Figure 2-11 and the results of the TBERA, current conditions are not protective of sensitive avian receptors or the shrew. The previous sentence could use supporting information from Tony. As a result, remedial action alternatives FP-1 and FP-2 do not meet the threshold criteria of protectiveness as specified in the NCP.
- SC 46) Page 5-36. MDEQ does not agree with the statement that FP-1 and FP-2 are protective. See comment on Page 5-25 above.
- SC 47) Page 6-2. The draft FS concludes that alternatives SED-1 and SED-2 are protective of the 100% bass diet fish consumption exposure scenario. However, as stated previously, recently collected smallmouth bass tissue (2006, 2009 and 2011) to do not demonstrate any appreciable reduction in fish tissue PCB levels. As a result, MEQ has little confidence that alternatives SED-1 and SED-2 will meet EPA’s protectiveness criteria for either the mixed diet or the 100% bass diet exposure scenarios.
- SC 48) Page 6-2. As stated previously, the proposed PRG of 0.33 mg/kg is not risk based. The draft FS should evaluate other PRGs considered protective of human health under various exposure scenarios such as 0.12 mg/kg and 0.2 mg/kg.
- SC 49) Page 6-2. As stated previously, alternatives 3A/B, 4A/B and 5A/B do not show appreciable risk reduction relative to alternatives 1 (no action) and 2 (MNR).
- SC 50) Page 6-3. As stated previously, MDEQ does not agree with the statement that FP-1 and FP-2 achieve RAO 3.

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Milt Clark Jan 24, '13, 3:30 PM Need to distinguish between subsistence and recreational. Add bass targets also.

- SC 51) Page 6-3. As stated previously, MDEQ believes that a new RAO is required that addresses long-term bank stability and prevention of PCBs remaining in the floodplains from entering the river in the future.
- SC 52) Appendix C2. MDEQ disagrees with many of the conclusions presented in appendix C2 regarding the effectiveness of fish consumption advisories. Fish consumption advisories have been in effect at the Kalamazoo River since DATE. However, recent surveys DATE show that sport anglers and subsistence fishers still continue to consume fish from the Kalamazoo River. This comment needs more specifics regarding the effectiveness of fish consumption advisories. In addition, EPA's 2005 sediment guidance includes the following caution regarding the use of institutional controls at contaminated sediment sites:
- "Reliability and effectiveness of ICs are of particular concern with sediment alternatives, whether they are used alone or in combination with MNR, in-situ capping, or sediment removal. Project managers should recognize that, generally, ICs cannot protect ecological receptors or prevent disruption of an in-situ cap by bottom-dwelling organisms. In addition, in many cases ICs have been only partially effective in modifying human behavior, especially in the case of voluntary or advisory controls." (Page 7-15)
- SC 53) Screening of Remedial Technologies (Section 6 of the ASTM): The results of the remedial technology screening process are described in the ES and presented in Section 6 of the ASTM. Section 7 of the TSTM describes the assembly of remedial action alternatives. However, the draft FS does not describe the site specific conditions that favor one alternative over another. The revised FS should include a section that discusses the results of the technology screening and the application of the various technologies to the Kalamazoo River site based on site specific conditions. Within the reach between RM 68.4 and 72.4, the river has a lower gradient, more accumulation of sediment and higher PCB levels. Other areas of the site have higher gradients, less accumulation of sediment and lower PCB concentrations. Technologies such as capping and enhanced MNR should be evaluated based on site conditions and the results of this evaluation used to assemble remedial action alternatives.







# MDEQ Response to EPA Request

Regarding: Area 1 FS for Kalamazoo Superfund Site dated October 30, 2012,  
prepared by ARCADIS on behalf of Georgia-Pacific

## USEPA Request

First in terms of comments.

1. A concise comment describing the need to include lipid based concentrations for fish and how that shows a decrease in decay rate. (This could be two comments) [Request 1 and 2]
2. A discussion of the problem with the SWAC calculations and a proposed alternative approach(es) [Request 3]
3. Given the SWAC and lipid discrepancies as noted above we should have the PRPs add sediment remedies for River sections 2, 3 and 4 (since the other areas have lower SWACs and we believe this is where the majority of the mass also exists) including removal to RALs of 2, 5 and 10. (We would need volumes and costs for each along with the decay curves.) If you believe that 2, 5 and 10 provide the same answer it may be more appropriate to reduce the number of RALs. [Request 4]

For further internal discussion.

A. Given the slower decay curves produced by John K. I would like to see where the various sediment remedies proposed by GP fall along the time curve and how they impact fish tissue concentration over time. (This issue speaks to the time interval used in RAO 1). I want to make sure the 10 year time frame is appropriate. [Request 5]

## **Request 1: Comment regarding need to include lipids in tissue and trend analysis**

MDEQ (Kern) evaluations indicate that the trends based on wet-weight PCBs overstate the rate of decline in carp and smallmouth bass tissue samples. Lipid content was found to explain a significant portion of the PCB decline. Therefore, much of the apparent decay of PCBs in tissue is explained by temporal variation in lipid content (see Figure 4 for carp, below). Extrapolation of wet weight PCB decay trends requires the assumption that lipid content trends will continue to decline through time as well. However, it is not possible for lipids to decline below species specific minimums and therefore PCB trend calculations need to consider and compensate for lipid trends. MDEQ has provided a draft report using a defensible approach to calculate PCB trends while accounting for changes in tissue lipid content.

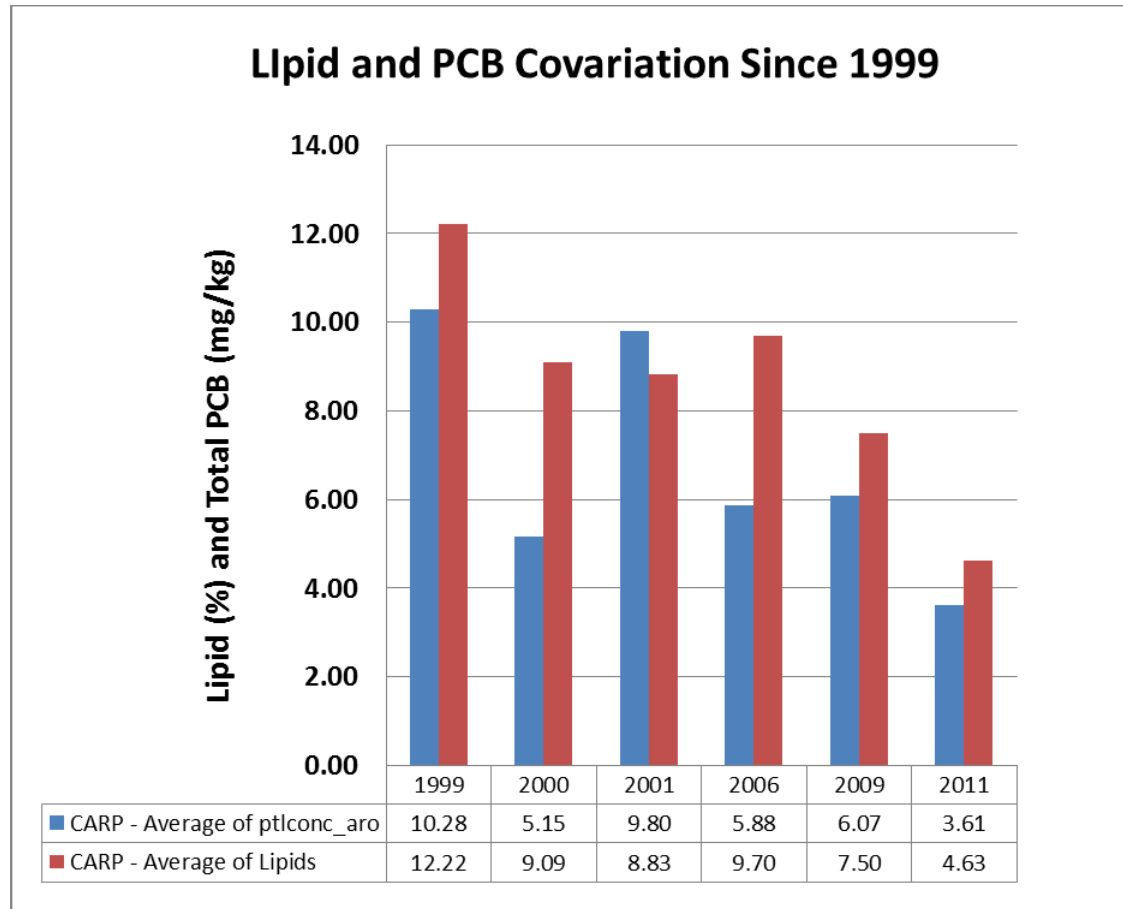


Figure 4 - Temporal decline in wet-weight PCB and lipid content in Carp fillets from Kalamazoo, Mosel and D-Avenue sampling stations.

#### Request 2: Comment on estimated PCB decay rates in fish tissue considering lipid trends

After adjusting for co-variation with lipid, temporal trends in tissue PCB concentrations were on the order of 3% per year (Table 3, below) as compared to 6% reported in the FS. Assuming these decay rates would continue indefinitely into the future, time horizons to even minimally protective fish tissue concentrations (e.g. Central Tendency Sport Angler, 100% smallmouth bass diet, tissue level of 0.2mg/kg) are on the order of 30 or more years as opposed to the much shorter time horizons reported in the FS. Further, fitting a mixed order model to fish tissue data indicated that decay rates are slowing with time, indicating that the assumption of indefinite first order decay rates represents optimistic forecasts.

**Table 3 - Regression function parameter estimates for temporal models.**

	Variable	Parameter Estimate	Standard Error	t Value	Pr >  t	Squared Semi-partial Correlation
Carp Fillets	Intercept	47.00	18.67	2.52	0.01	.
	year	-0.02	0.01	-2.53	0.01	0.03
	logLipids	0.92	0.07	12.72	<.0001	0.64
						Adjusted R <sup>2</sup> =0.70
Smallmouth Bass Fillets	Intercept	42.00	20.11	2.09	0.04	.
	year	-0.02	0.01	-2.12	0.04	0.02
	logLipids	0.79	0.08	9.34	<.0001	0.39
						Adjusted R <sup>2</sup> =0.61
Whole-body YOY Smallmouth Bass	Intercept	74.87	22.22	3.37	0.00	.
	year	-0.04	0.01	-3.45	0.00	0.10
	logLipids	1.11	0.13	8.64	<.0001	0.60
						Adjusted R <sup>2</sup> =0.80

**Request 3: Discussion of SWAC issues and recommended approach**

Methods used to estimate SWAC in Area 1 incorrectly combined “judgmentally-located ” (i.e. biased) samples with unbiased samples, understating the average PCB concentration in surface sediments by up to a factor of 9. This estimation bias is caused by 1) incorrect handling of data generated through post-hoc identification of hot-spot investigation areas; and 2) improperly combining biased and unbiased data within stream tubes in “non-hot-spot” areas. To avoid this problem of combining biased and unbiased data for wide ranging terrestrial species, it was agreed in the EPC work group meetings that only unbiased data would be used to estimate SWACs. The same rationale suggests that unbiased sample data should also be used for estimation of PCB exposure (i.e. SWAC) for wide ranging aquatic species including smallmouth bass and common carp.

Table 4 highlights the differences in SWAC values based on streamtubes, unbiased 93/94 data, and all unbiased data. Taken together it is recommended that the SWAC estimates reported in the Area 1 FS be replaced with estimates based on the arithmetic average of unbiased samples collected in 1993/94. Transect based, apparently unbiased, sampling programs were also conducted in 2000 and 2007, although it is unclear whether the spatial extent and balance is similar to that obtained in 1993/94, so uncritical use of these samples may also cause unintended biases. If the RPs desire to combine samples collected in 2000 and 2007 with those from the 1993/94 survey, they should be carefully evaluated in consultation with USEPA and the MDEQ prior to incorporation into SWAC estimates. Detailed findings supporting this comment can be found in the accompanying memorandum.

Table 4 - Total PCB Concentration in surficial sediments.													
SRI Reach	Supplemental FS			MDEQ Analysis									
	Stream Tube			Unbiased Samples (1993-1994)					All Unbiased Samples (1993-2007)				
	N	SWAC (mg/kg)		Sample Count	SWAC (mg/kg)	LCL 95	UCL 95	Thiessen Poly SWAC (mg/kg)	N	SWAC (mg/kg)	LCL 95	UCL 95	
Morrow Dam to King Highway	1	85	0.072	80	0.19	0.10	0.41	0.12	97	0.17	0.09	0.30	
King Hwy to Portage Creek	2	29	0.26	41	2.41	0.18	10.63	4.42	66	4.30	0.50	9.38	
Portage Creek to Mosel Ave	3	30	0.35	17	2.91	0.30	13.18	4.95	50	1.30	0.36	3.87	
Mosel Ave to D-Ave	4	130	0.43	81	1.24	0.34	4.64	4.66	139	0.94	0.36	2.38	
D-Ave to RR Bridge	5	110	0.31	65	0.42	0.25	0.77	0.67	89	0.51	0.30	0.82	
RR Bridge to Plainwell No 2.	6	24	1.1	9	0.24	0.09	0.47	0.45	18	0.30	0.15	0.50	
Plainwell No2. to Main Street Plainwell	7	39	0.96	8	0.78	0.18	2.46	1.39	52	1.72	0.46	4.39	

#### Request 4: Add remedies for Area 1 Sections 2, 3, and 4 with additional RALs

Given the issues identified above, MDEQ supports EPA in requesting the RPs to add additional sediment remedies to reflect additional options that decision makers may wish to consider in making risk-based remedy decisions. Using the instream RALs of 1, 2, 3, 5, and 10 mg/kg the following figure was prepared to illustrate unbiased estimates of volumes by Area 1 river reach. Note that Section 8 represents pre-TCRA conditions and is presented for reference only.

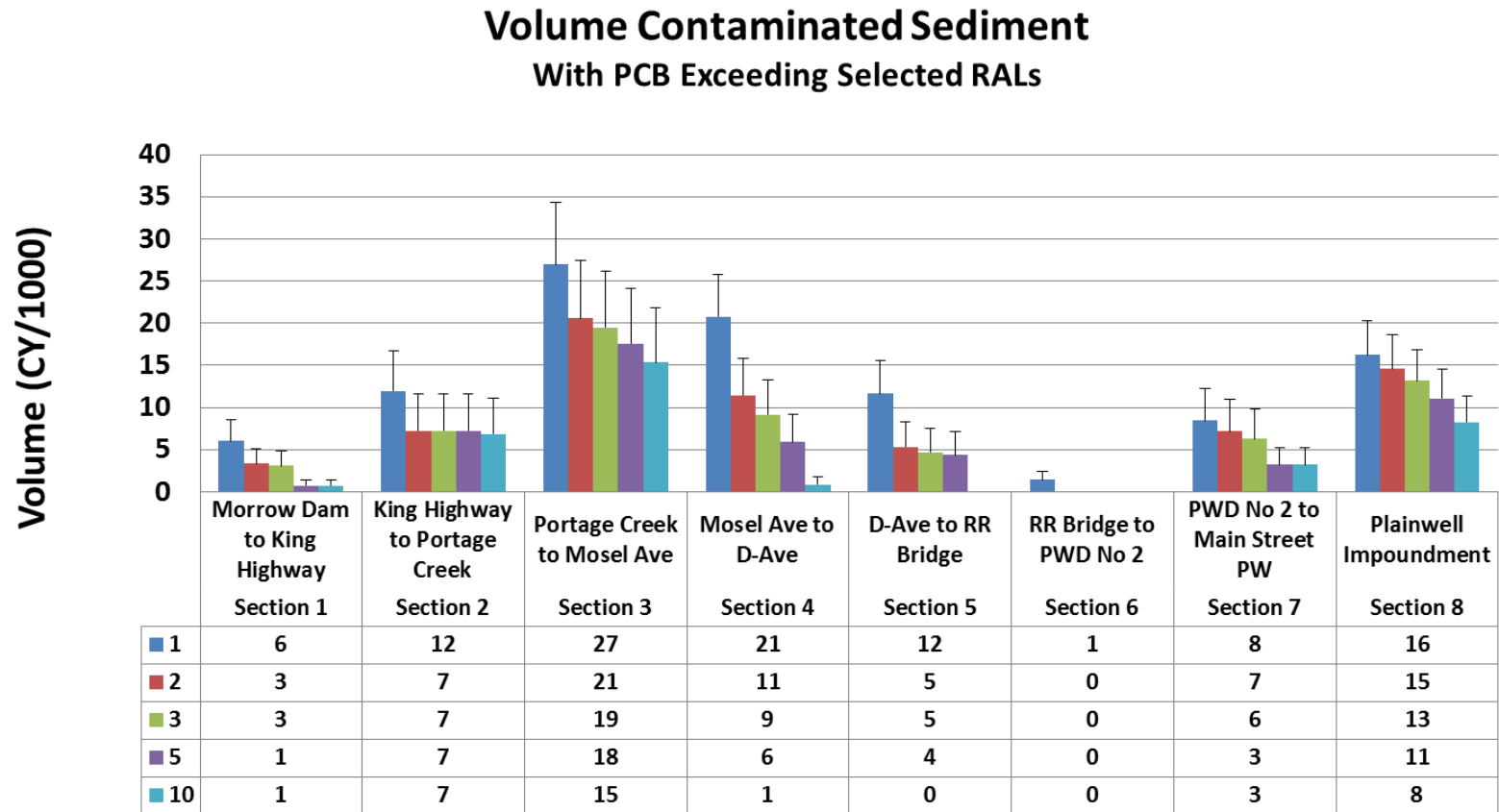
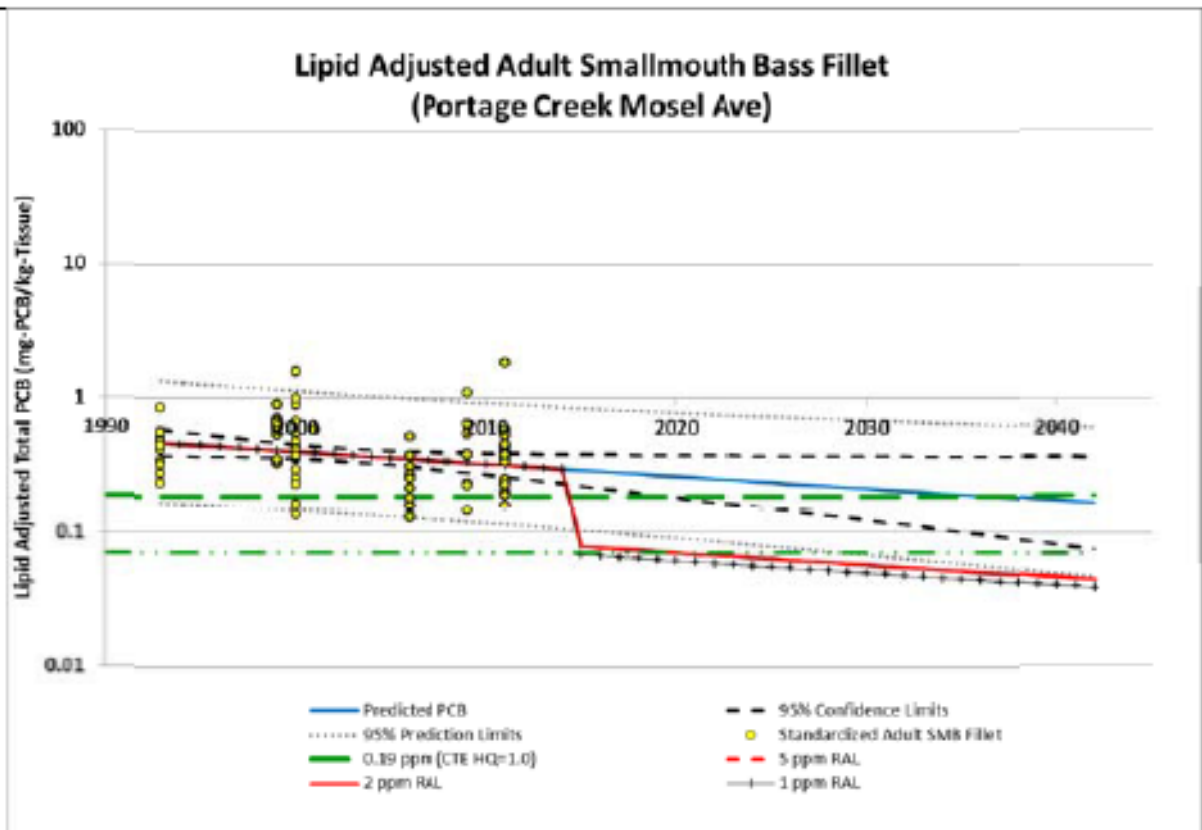
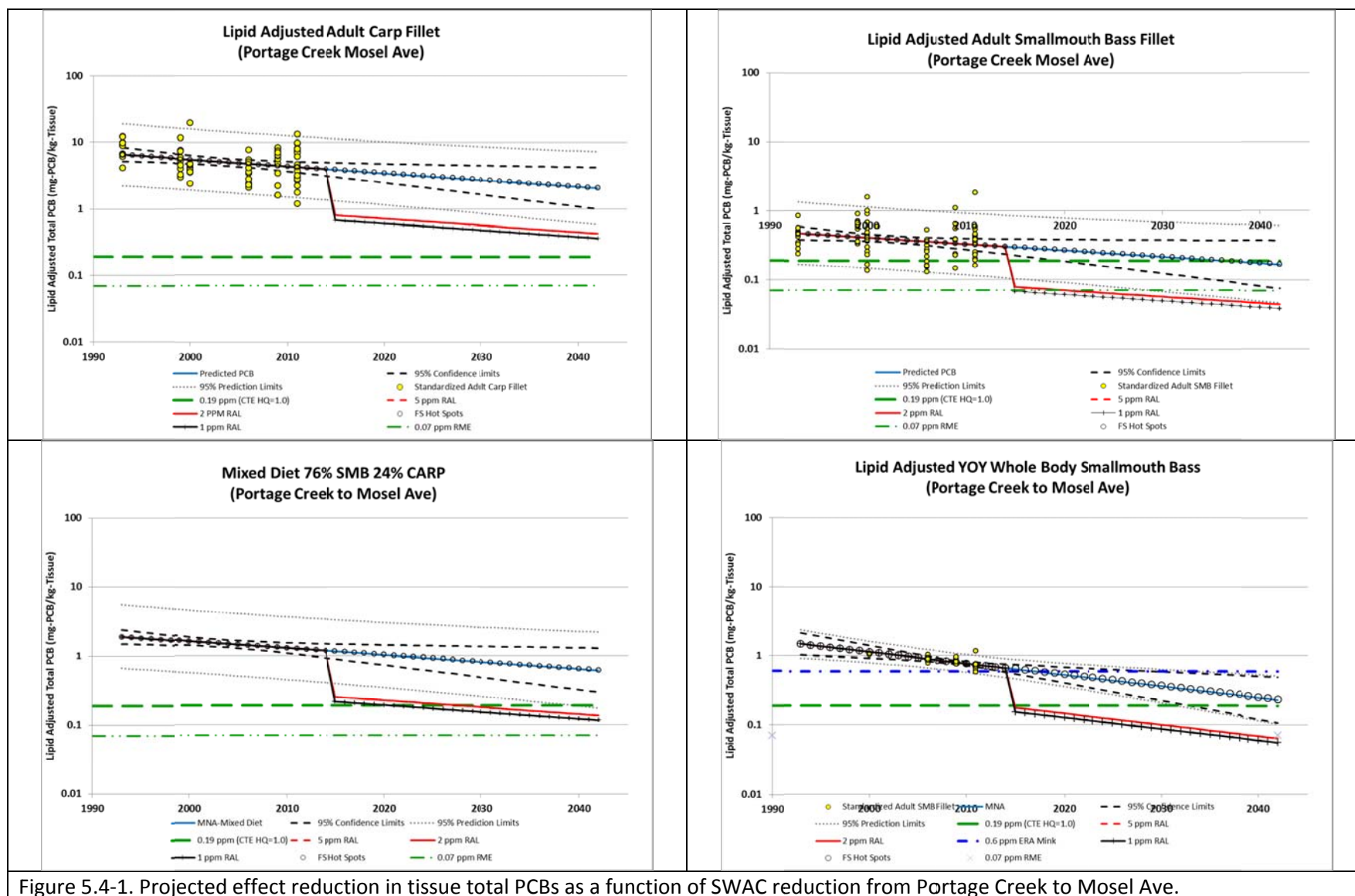


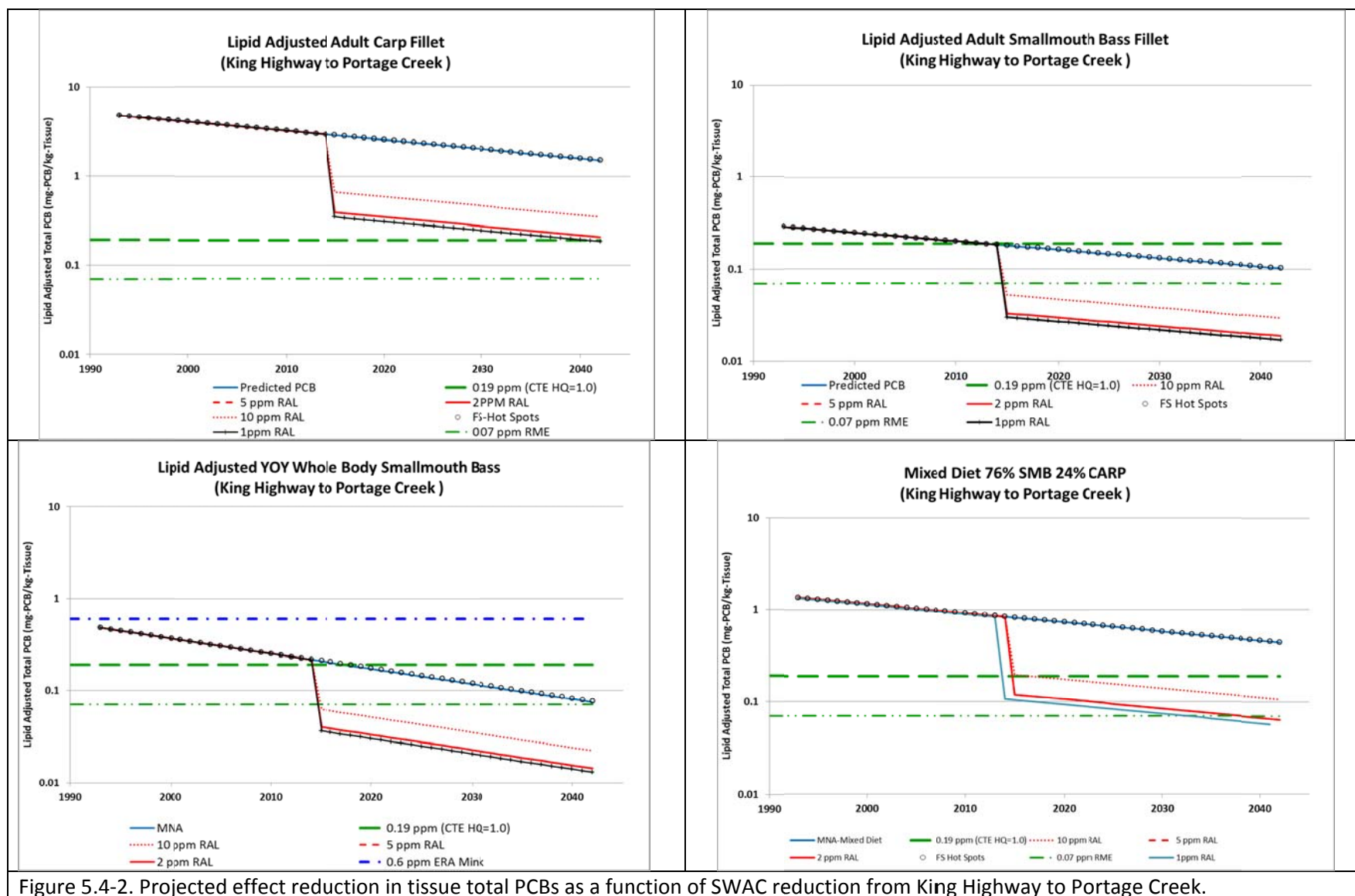
Figure 12 - Volume of PCB containing sediments associated with remedial action limits of 1, 2, 3, 5 and 10 mg/kg.

### Request 5: Given the MDEQ trend estimates, how do GP remedies impact the fish tissue concentration vs. time curves

Based on the issues related to SWAC and decreased time trend estimates, the first order monitored natural recovery line, represents our best estimate of the fish tissue response to the GP proposed alternatives SED 1 through 5. SED 6 would be expected to fall on the 1 ppm RAL line as shown in the following figure for the Portage Creek to Mosel Avenue reach (Section 3). This will be refined based on discussions with EPA and RPs once the requirements of the additional alternatives have been defined.









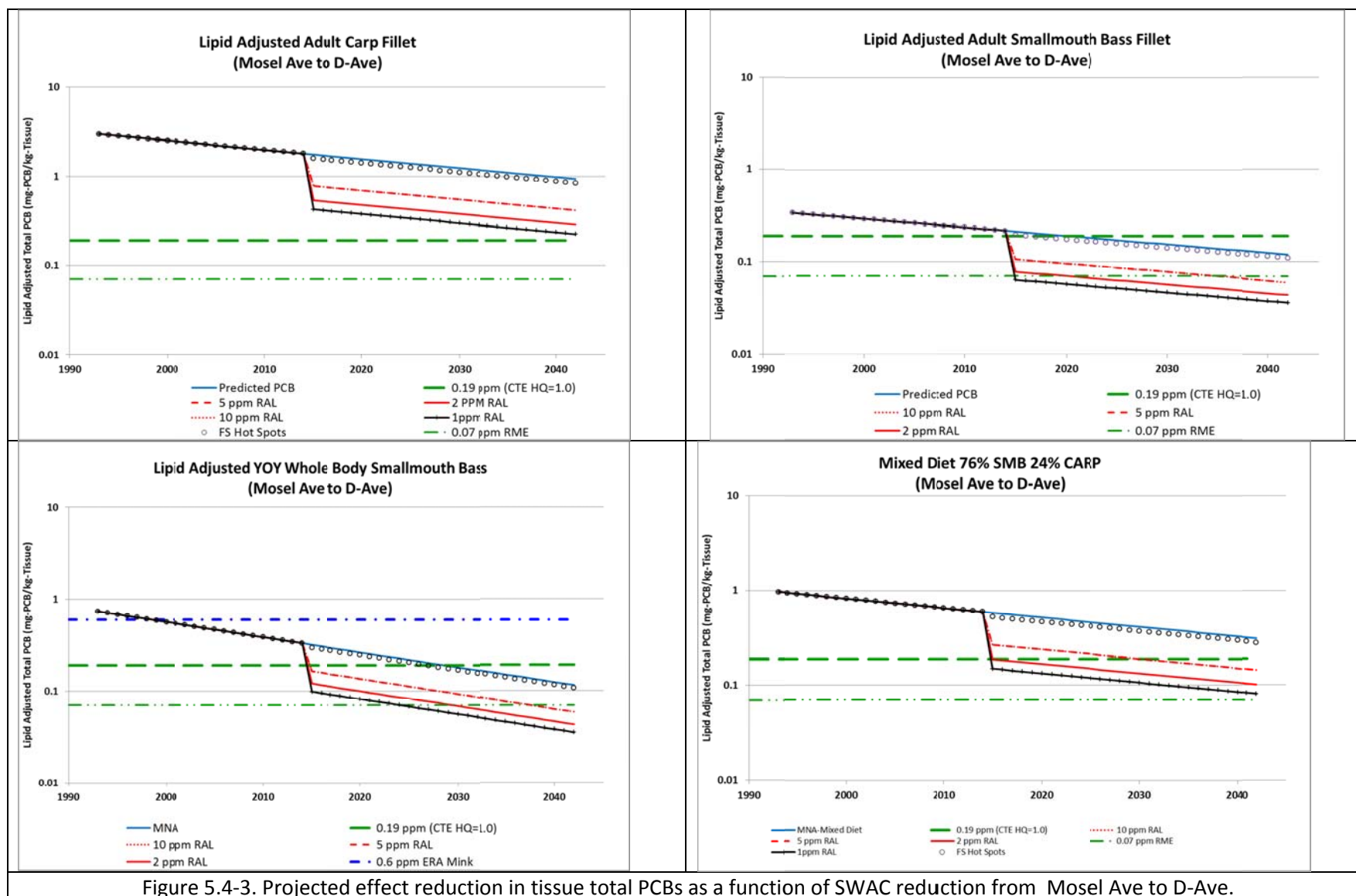


Figure 5.4-3. Projected effect reduction in tissue total PCBs as a function of SWAC reduction from Mosel Ave to D-Ave.

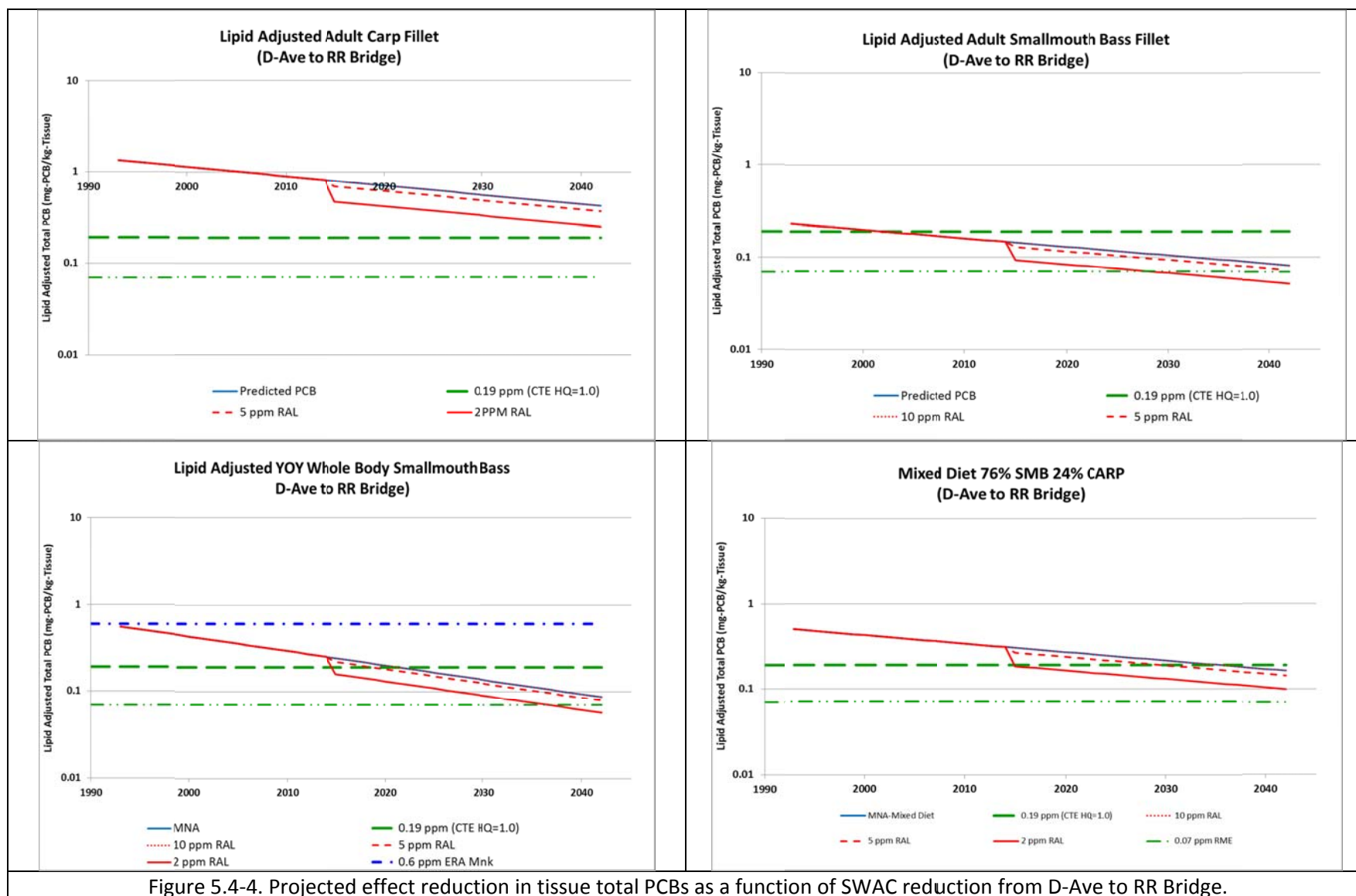


Figure 5.4-4. Projected effect reduction in tissue total PCBs as a function of SWAC reduction from D-Ave to RR Bridge.